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A COMPREHENSIVE VIEW ON THE EVOLUTION OF URBAN SPATIAL STRUCTURE OF THE LARGEST POST-SOVIET CITIES IN RUSSIA

Abstract: *The article describes the development trends of urban spatial structure of the largest Russian cities since the 1990s to the present. The author considers the urban density as a key concept in the description of a city's urban spatial structure. Other three key characteristics of cities are population size, the total area of the city and urban morphology. This paper discusses the analytical opportunities that recent data offer in regard to an objective and transparent measurement of urban density patterns of largest cities in Russia. The author applies this approach to 10 cities to demonstrate the analytical capacity of spatially-refined density indicators for the purposes of comparative urban research. In so doing, the article examines the features of the change in the morphology of post-Soviet cities. Transformation of urban morphology is the performance parameters of the spatial organization of buildings, vertical functional zoning, changing the ratio of built-up and open spaces in the existing planning units of the urban fabric, and new configurations of inter planning. The author has identified the factors influencing the change in the morphology of cities. Detailed study of urban development at the level of morphological units allowed us to formulate the following conclusions. First, the return to the use of historical traditional morphotypes in the projects of new residential development; secondly, the transformation of traditional historical morphotypes; thirdly, the invasion of new morphotypes, urban blocks that were previously not peculiar to Soviet cities. The study contributes to a more comprehensive understanding of the concept of urban density in the analysis of urban spatial structure and urban morphology of post-soviet cities. The results of the morphological analysis of the development of contemporary Russian cities can be used for the prediction of the urban structure future development.*

Keywords: *urban spatial structure, urban morphology, morphotype, urban blocks, density measures, built density, post-soviet city.*

Introduction

In the early 21st century in many large cities of Russia urban transformations had become noticeable, which determined the different directions of changes in urban morphology. Due to socio-economic restructuring caused by the processes of globalization, the development of urban space increasingly takes on such forms, which not only remove the acuteness of previous problems, but, on the contrary, they are aggravated and increased, due to the emergence of the new ones (Lyubovny, 2013). The transition to the market economy and development in the context of globalization necessarily leads to some standardization of spatial development trends, convergence of the morphology of Russian and foreign cities, originally formed under market conditions (Kozhaeva, 2011).

In this regard, the study of occurring transformations of urban spaces, identification of trends in changing of a physical form and architectural skyline of the largest Russian cities, analysis of the transformations of the historical structures and identification of new morphotypes has become particularly relevant.

Methodology

Ten major cities – regional centers of Russia (“megapolis”) as well as cities, which at various times have been the platforms for major international events (Sochi, Kazan, Vladivostok), are chosen as the objects of survey. The study is based on a comparative analysis of basic characteristics such as planning structure, territory, density, and number of stories in a building (height).

Measurement and analysis

At the first stage of our research, we will consider the spatial relationships within the selected cities in more detail. It would be hard to think of any significant question or judgment of urban science, without affecting the space, the dynamics of territorial growth or the population, as fundamental problems. Our intention in this part is to expose some essential aspects of the spatial structure of cities. In this way, it will be possible to affirm some new characteristics of this process, which are especially relevant and useful for understanding the development of cities and their problems.

The study has shown variation of urban parameters (Table 1).

Table 1

Comparison of the urban characteristics of the largest Russian cities ¹

City	Population size (2017)	Total area km ²	Density of population person /km ²	Number of districts
Novosibirsk	1602,9	505,62	3061	10
Yekaterinburg	1455,5	491	2900	7
N. Novgorod	1261,7	410,68	3077	8
Kazan	1231,9	425,3	1915	7
Chelyabinsk	1198,9	500,9	2334	7
Omsk	1178,4	572,9	1968	5
Samara	1169,7	541,4	2164	9
Rostov-on-Don	1125,3	348,5	3184	8
Ufa	115,6	707,9	1549	7
Krasnoyarsk	1082,9	359,3	2765	7
Volgograd	1015,6	859,4	1184	8
Voronezh	1039,8	596,5	1701	6
Krasnodar	805,7	190,2	4192	4
Vladivostok	603,2	331	1822	5
Sochi	399,7	176,8	2261	4

Volgograd and Ufa have the largest metropolitan area. Rostov-on-Don and Krasnoyarsk are the smallest by area. Other cities have median value of about 500 sq.km.

Consequently, differences in population density can be clearly seen (Fig. 1). The most densely populated cities are Krasnodar (4192 persons/sq. km), Rostov-on-Don (3184 persons/sq. km), Nizhniy Novgorod (3077 persons/sq. km) and Novosibirsk (3061 persons/sq. km). The less densely populated cities are Volgograd (1184 persons/sq. km) and Voronezh (1701 persons/sq. km).

The area of most Russian cities with *more than 1 million* inhabitants is comparable with the territories of the European largest cities such as Vienna, Budapest, Munich, Warsaw, and Prague. However, the comparison of the density indicators shows that the density in European cities is much higher and it is about 5000 persons/sq. km averagely. That is roughly twice the density figure of the Russian cities (2000-2500 persons/sq. km).

The indicator of the volume of new residential development gives the opportunity to indirectly assess the activity of urban infrastructural development (Fig. 2).

¹ According to Federal State Statistics Service: <http://www.gks.ru/>.

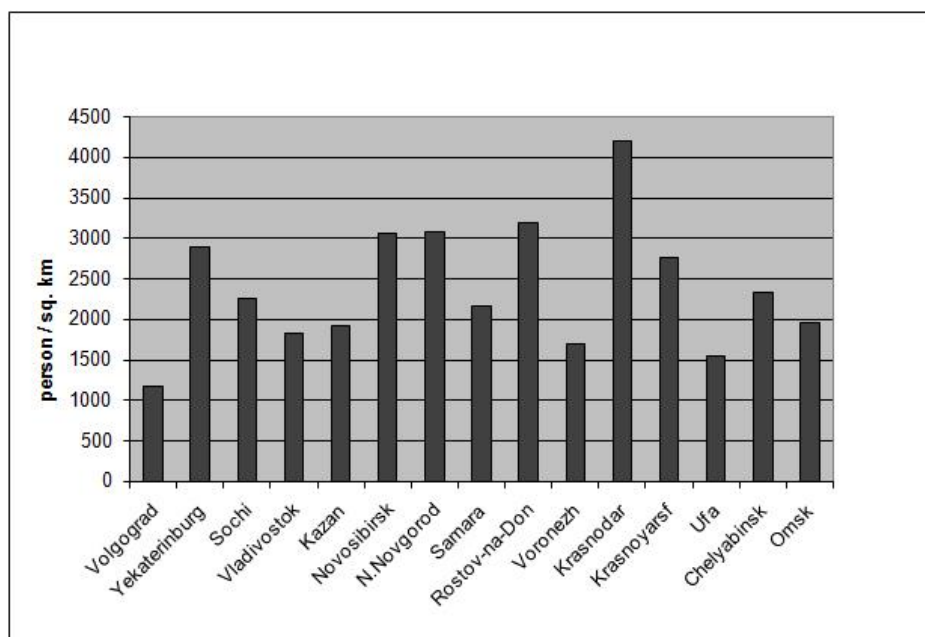


Figure 1. Population density in the largest cities of Russia

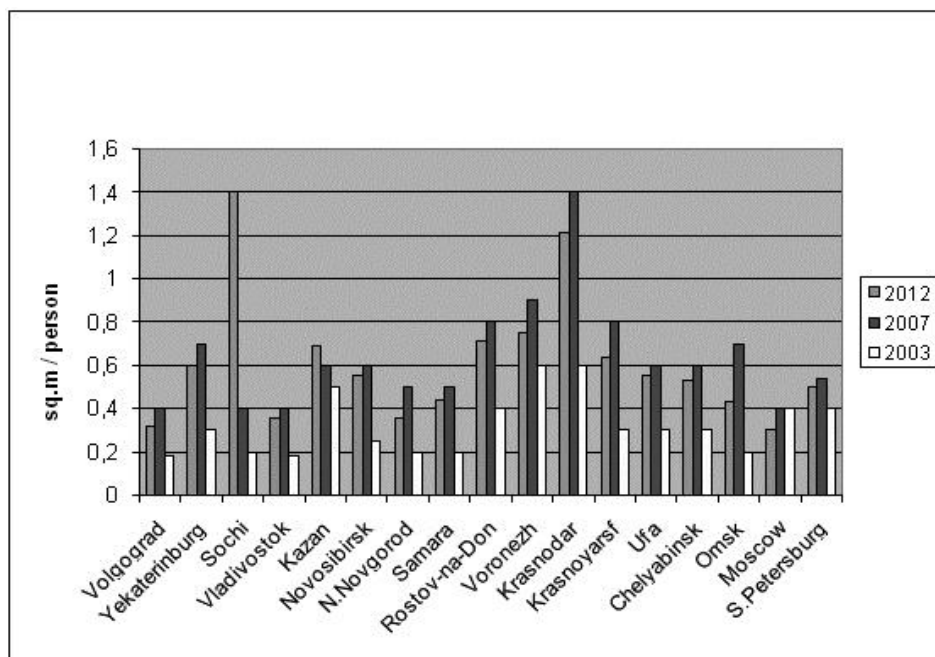


Figure 2. Apartment construction at in the largest cities of Russia (sq.m/ person)

In accordance with the data of 2012-2016, the most actively developed cities are Sochi and Krasnodar, Kazan, Rostov, Voronezh and Krasnoyarsk are in the middle. In these particular cities the restructuring of the morphological structure is very active. Slow growth is evident in Volgograd, Nizhniy Novgorod and Vladivostok.

Thus, analysis of the changes in the planning structure showed that during the period of the early 2000s, when master plans of the cities had been developed, increase of the spatial borders of municipal entities had taken place. The growth was often justified by the maintenance of a high population level due to inclusion of suburbs (Volgograd, Voronezh, Ufa). Thus, for instance, Volgograd increased its area from 400 sq.km to 859, 4 sq.km, accordingly the population density was decreased from 2579 persons/sq. km to 1184 persons/sq. km (Fig. 3).

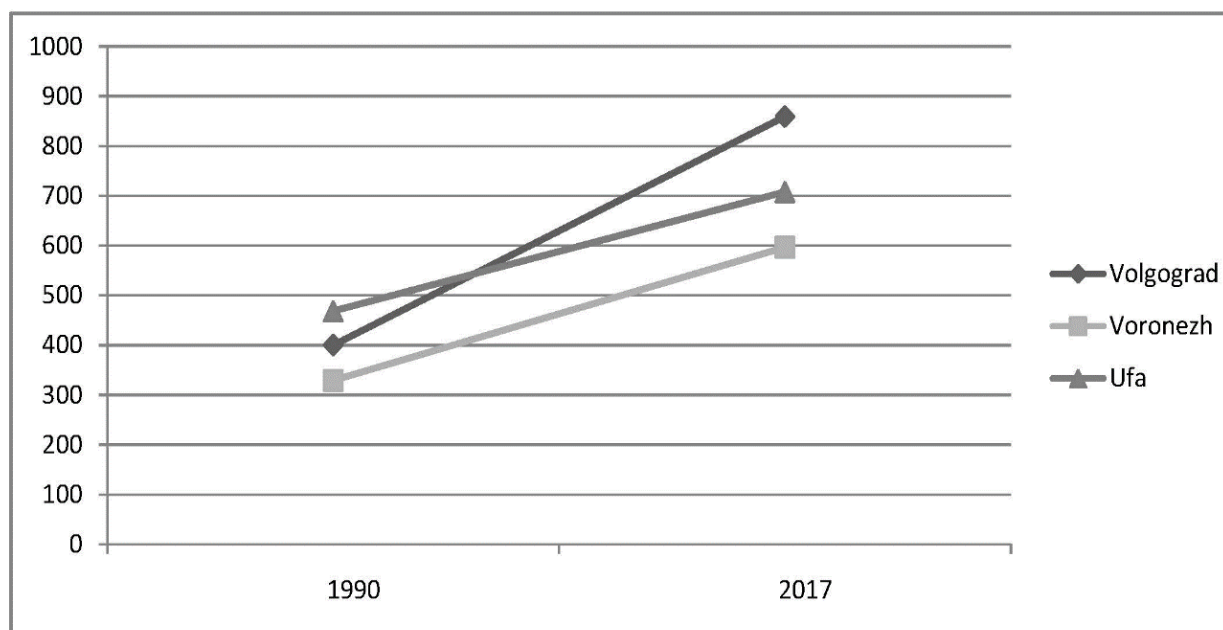


Figure 3. The territorial changes of the cities of Volgograd, Voronezh and Ufa, km²

It is necessary to note, that the process of the urban compaction of the country, which took place in the Soviet period (1970-1980s), had been stopped in the 1990s, long before the moment when actual need for territorial growth became evident. Reforming of the social and economic foundations of the State dramatically slowed urban development processes.

However, the following period – the beginning of the twenty-first century (2000-2007) did not become a time for structural changes. Rather, it can be described as a period of “spatial expansion” of cities (Table 2).

The matter is that when, in accordance with the changed urban planning legislation, new urban master plans of cities were being developed, urban municipalities tried to increase their spatial boundaries. This growth was often justified by the desire to support high population level by dormitory suburbs which were included to keep the figures and join the ranks of the largest cities with the population over 1 million people. The conclusion can be made that in many cities the urban fabric/structure had become less dense and large spatial “gaps” appeared. In the same period, in parallel with the overall territorial growth, urban compaction becomes noticeable within the boundaries of the historical centers of cities.

The second part of our study is devoted to changes in the morphological structure of cities, the identification of new morphotypes and urban parameters.

One of the most popular techniques, such as incorporation of new buildings in historical districts appeared, and the occurrence of such concepts as “infill” became popular. High-rise building parameters have been changed: a building with a height of more than 30 floors appeared within the boundaries of historic centers, for example, complex “Volga Sails” in Volgograd, “The Alexandrian Pillar” in Sochi and residential complex “Olympic” in Yekaterinburg (Fig. 4).

During this period, active construction of the first in history of the local urban “islands of skyscrapers” – Business Center in Moscow – took place. Following the Moscow Business Center, numerous projects of skyscrapers in all major cities of Russia appeared, that radically changed the urban morphology. However, these projects have been implemented so far in only two cities Yekaterinburg and Grozny.

Analysis of the current situation enables to state that the territorial growth phase in all the surveyed cities and towns comes to an end. Within the fixed borders in building master plans, the development of the territories acquires on the one hand, a more rigidly structured state; on the

other hand, urban morphology acquires more heterogeneity. The urban fabric is compacted with varying degrees of intensity, creating a variety of development types from discharged low-density development to relatively high-density development with a sufficient degree of fixity. Urbanized frame is developed along the streets and roads and it to a little extent changes the lay-out for a long period of time. However, the development of territories close to the main arteries is constantly compacted and modernized. Territories close to the main arteries acquire the properties of a magnet, attracting public functions and residential development as well.

Table 2

Changes in the spatial planning structure of the cities Volgograd, Voronezh, Ufa



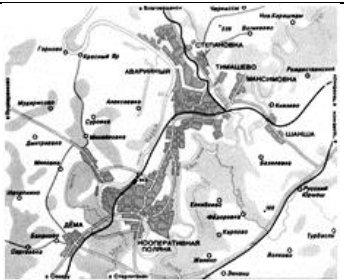



1990			
2017			
	Volgograd	Voronezh	Ufa



Figure 4. Groups of high-rise buildings as a new morphotype in the urban development of Yekaterinburg. Residential complex “Olympic”. Project

A more detailed study of urban development at the level of morphological units led to the following conclusions:

1. Return to using historical traditional morphotypes in new residential projects. In particular, it is expressed by widespread use of urban quarter as the main city planning structural unit (from house-quarter to enlarged quarter) (Fig. 5). Neighborhood (micro-district) as a structural unit has been atrophied (Kukina, 2005).

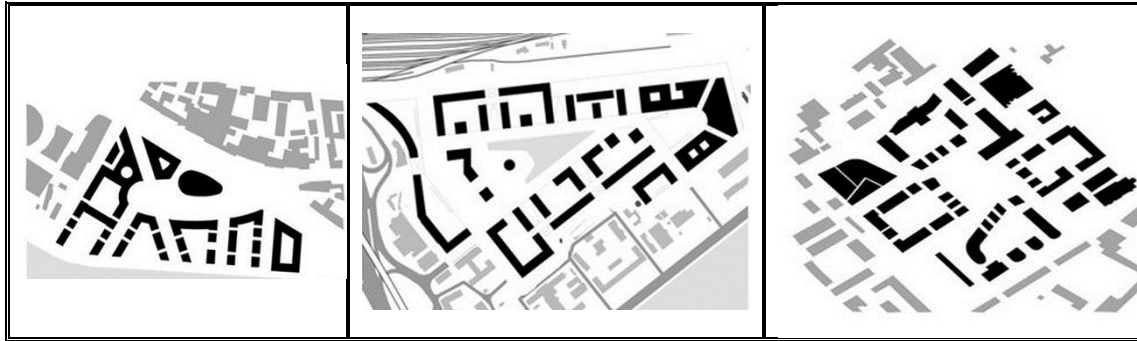


Figure 5. Using historical morphotypes in urban development projects:
1 – European embankment, St. Petersburg; 2 – Berezkhovskaya embankment, Moscow;
3 – Garden Quarters, Moscow

2. Transformation of traditional historical morphotypes. Historical morphotypes are understood as elements of urban blocks (patterns) representing the historical and cultural value of the types of city development that existed until the mid-twentieth century, each of which is characterized by its own spatial planning, architectural and compositional forms of planning and development. Morphotypes determine the historically formed uniqueness of the plots of the urban development environment. In each city, researchers identify specific historical morphotypes. For example, in Kazan, there are 10 main morphotypes, in Moscow – 6, in Novosibirsk – 4 (Ptichnikova, 2014).

These processes happen in the following way:

- infill of new development to the existing urban blocks by the method known as “filling” of the urban fabric (Paskhina, 2012);
- achievement of maximum parameters in the number of floors and built-up density and increase in the degree of the land development (Kozhaeva, 2011) (Fig. 6);
- implementation of new functions within formed monolithic structural units (Krashennikov, 2012; Talen, 1999).

As a result, low-rise and middle-rise urban blocks are converted to various-rise, due to the growth of the degree of development, number of stories and density.

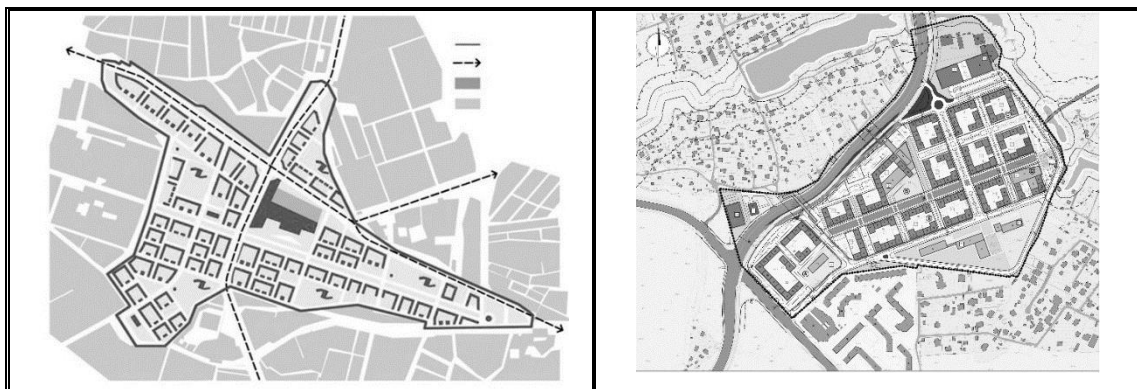


Figure 6. New condensed morphotypes inside the historic urban structure:
1 – Development of the territory in Saratov. Scheme of quarter division;
2 – Residential complex “Spanish quarters”. New Moscow

3. Invasion of new morphotypes and elements into the urban structure, which were not previously peculiar to Russian cities (Table 3).

These kinds of transformation are similar to modern urban patterns of Asian cities – compounds. The term “compound house” has been used to describe a traditional form of Chinese housing that accommodates the extended family in several dwellings within the same walled habitat (Greive, 2005). Currently, the compound can be called the quarter when applied to a human habitat, refers to a cluster of buildings in an enclosure having a shared or associated purpose.

In Russia “compound” may refer to a much larger collection of dwellings, as a synonym for an autonomous multi-apartment residential complex with a large set of infrastructure and fenced walls, as well as security systems. As for examples we can mention the “Zhivago Compound” or “Sun City” in Perm, “Dominant” in Volgograd, “Olympic” in Yekaterinburg, etc. (Fig.7).









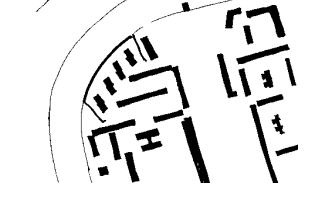

Figure 7. Residential complex “Sun City”, Perm

The most common characteristics of such compounds are socio-spatial apartness from outside environment, inaccessibility to outside penetration; height (from 20-35 floors and above), high development degree, private infrastructure service. The towers are the main tools in creating the architectural image of the compounds, ranging from single buildings (“February revolution”, Yekaterinburg) to clusters (residential complex “Jamaica”, Sochi).

Table 3

Examples of new morphotypes of residential complexes

Characteristics and parameters	Morphological structure	Architectural Image
Residential complex “Actor Galaxy”, Sochi 1 building 26 floors Land plot area 2.04 hectares		 Single building

Residential complex “First Nikolaevsky”, Yekaterinburg 4 buildings 26 and 14 floors Land plot area 3.6 hectares		 Two towers
Residential complex “Dominant”, Volgograd 3 buildings 24 floors Land plot area 1.24 hectares		 Three towers
Residential complex “Admiralteysky”, Volgograd 4 buildings 21 floors Land plot area 2.0 hectares		 Group

In addition to compounds, we can refer to the new morphological types – line houses, duplexes and villetes. Currently, these varieties of townhouses are actively being introduced into the suburban development of Russian megacities.

Conclusion

Detailed study of urban development at the level of morphological units allowed us to formulate the following conclusions. First, the return to the use of historical traditional morphotypes in the projects of new residential development; secondly, the transformation of traditional historical morphotypes; thirdly, the invasion of new morphotypes, urban blocks that were previously not peculiar to Soviet cities. The study contributes to a more comprehensive understanding of the concept of urban density in the analysis of urban spatial structure and urban morphology of post-soviet cities. The results of the morphological analysis of the development of contemporary Russian cities can be used for the prediction of the urban structure future development.

Thus, the study identified some general trends in the development morphology of the largest Russian cities. The following structural transformations became evident for most cities: changing parameters of spatial organization of the developed territory; emergence of a vertical functional zoning not only in capital cities, but in regional centers as well; changes in the ratio of open and built-up spaces under the planning units of urban structure; functional and structural changes of public urban spaces; new configurations of development morphotypes.

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